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| PATENT APPLICATION TRANSMITTAL LETTER (Large Entity) | Docket No. INTL-0478-US (P10026) |

TO THE ASSISTANT COMMISSIONER FOR PATENTS

Transmitted herewith for filing under 35 U.S.C. 111 and 37 C.F.R. 1.53 is the patent application of:

SANJAY S. GADKARI

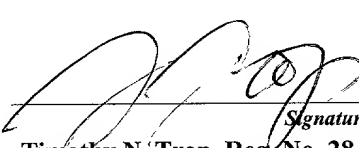For: **MANAGING A NETWORK OF CONSUMER-USE COMPUTING DEVICES**

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Dated: **November 17, 2000**

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P01LARGE/REV06

APPLICATION

FOR

UNITED STATES LETTERS PATENT

TITLE: MANAGING A NETWORK OF CONSUMER-USE
                COMPUTING DEVICES

INVENTORS: SANJAY S. GADKARI

Express Mail No. EL669041139US

Date: November 17, 2000

MANAGING A NETWORK OF CONSUMER-USE COMPUTING DEVICES

Background

This invention relates generally to processor-based systems and particular to networks of processor-based

5   systems used by consumers.

Managed networks of consumer-use computing devices enable consumers to off load the management of their home processor-based system to a remote service provider. The service provider may remotely maintain the system resident

10 in the user's home. Remote diagnostic devices may be utilized to analyze any software or hardware problems as they arise on the home-based system. A remote server may monitor each home-based processor-based system for alerts. In addition, the remote server may provide software

15 upgrades for those systems.

Ideally, the remote server works seamlessly with each home-based processor-based system in the network since the nature of each home-based processor-based system may be specified by the service provider. Alternatively, a

20 network service provider may provide the software and hardware that make up each of the home-based processor-based systems in the network.

For example, each of the home-based processor-based systems may be persistently connected to the server. In

one example, the server may be a simple message system (SMS) server. The server, in persistent communication with each of the home-based processor-based systems, knows what each processor-based system is doing at any time. The

5   persistent connection may be maintained using a predetermined address and port.

The service provider may provide television-related data services, shopping, banking or other services. Thus, the consumer may use the processor-based system to receive

10   a range of services that may be facilitated through software provided by the service provider. The processor-based system may be a desktop computer, a set-top box, or a processor-based appliance, as a few examples.

The success of the service provider may be dependent,

15   in part, on providing the greatest possible value to each network user. This may enable the service provider to provide its services at the lowest possible cost.

Thus, there is a need for better ways to obtain the greatest possible value from networks of managed consumer-

20   use computing devices.

Brief Description of the Drawings

Figure 1 is a schematic depiction of one embodiment of the present invention;

Figure 2A is a flow chart for software for operating a

25   server in accordance with one embodiment of the present invention;

Figure 2B is a continuation of the flow chart shown in Figure 2A; and

Figure 3 is a flow chart for software stored on a client in accordance with one embodiment of the present invention.

Detailed Description

Referring to Figure 1, a managed network 10 of consumer-use computing devices or clients 16 may provide a on-demand or persistent connection between each client 16 (only one of which is shown in Figure 1) and a server 12. In one embodiment of the present invention, the server 12 manages the operations on each of a large number of clients 16 over a network 14 such as wide area network, local area network, a metropolitan area network or the Internet as examples. In one embodiment, the server 12 may be a system management server (SMS).

As one example, the server 12 may communicate over a predetermined, persistent connection with each client 16. For example, a predetermined address and port may be utilized to facilitate two-way communications between each client 16 and the server 12. The persistent connection may be a cable or telephone connection such as a digital subscriber link (DSL).

The server 12 may monitor all operations which occur on each client 16. Thus, the server 12 may know at any instance of time what the client 16 is working on. In

addition, the server 12 monitors the health of each client 16 and watches for alerts from each client 16.

In some embodiments of the present invention, the hardware and software available on the client 16 are known

5 to the server 12. For example, in one embodiment, the client 16 hardware and software may be provided by a service provider that manages the network 10. Thus, the service provider knows how the client 16 may operate and may even provide additional hardware and software related

10 services such as software upgrades. In addition, if a software or hardware problem occurs on the client 16, remote diagnostic systems may be utilized by the server 12 to resolve those client 16 problems remotely from the server 12.

15 As a result, the server 12 may determine the available computing resources of the network 10. That is, at any given time and over any given period, the server 12 can determine the available computing resources in the network 10 because the server 12 knows the client's capacity and

20 average computing load, including memory, network, processor and disk utilization. Since the activity on the client 16 may be affected asynchronously by operations initiated by the user of the client 16, the server 12 can develop models that indicate, for given times of day and

25 given days of the week, the available resources in the network 10. The models may be developed from a history of

computing load. In this way, the server 12 software can
dynamically predict at any given time or over any given
time period, what distributed computing jobs may be
completed by idle network resource made up of all the

5   unused resources of all the clients 16 in the network 10.
Moreover, in some embodiments the server 12 has complete
control over the client 10 including the ability to prevent
the user from interfering with any distributed computing
tasks assigned to the client 16.

10   As a result, a service provider that operates the
network 10 may offer for sale to third parties, the use of
any unused distributed computing resources of the network
10. The third party's software and data may be downloaded
from the server 12 to clients 16 to enable the clients 16

15   to complete all or part of a overall distributed processing
job. The data may then be returned by the client 16 to the
server 12 for assembly. The results from the client 16
computing resources may then be reported to the third
party. This may all be done without significant disruption

20   to the services provided by each client 16.

The server 12 may be a processor-based system that
includes a storage that stores the software 18. Similarly,
the client 16 may be a processor-based system such as a
desktop computer, a set-top box, a processor-based

25   appliance, as examples, including a storage that stores the
software 20.

The server software 18, in accordance with one embodiment of the present invention, distributes third party processing jobs to the clients 16 in the network 10. Initially, the software 18 parses a processing job into

5 tasks and develops task packages including code and data, as indicated in block 22. Thus, the server 12, in one embodiment, may take an overall computing job and may divide it into tasks that are amenable to being operated on at each client 16. An overall job may be divided into a

10 number of tasks that are of sufficiently small size and require no more resources than those available on a given client 16.

Each task may then be provided as a package that may be communicated over an existing persistent communication

15 link from the server 12 to each client 16 in one embodiment. Each package may be assigned to a particular client 16 as indicated in block 24. The client package assignments may then be logged on the server 12 with delivery times and expected completion times as indicated

20 in block 26.

The server 12 keeps track of which package was sent to each client 16. The server 12 may do this by maintaining a list of packages and package identities together with a corresponding identifier for the client 16 that is

25 receiving the package. Since the available resources on the client 16 are known, the server 12 can determine an

expected task completion time. For example, the server 12 may utilize system-wide average idle cycle time information to determine an expected completion time of an assigned task by any given client 16. Alternatively, the server 12

5   can use statistics associated with each client 16 to determine the expected completion time.

In one embodiment of the present invention, the client 16 may execute the assigned task during idle cycles. Thus, the processing job may be completed by a plurality of

10   clients 16 using otherwise unused cycles. These unused cycles may occur at night when the client 16 is not operating or in the day when the user happens not to be using the client 16. In a multitasking environment, the task may also be completed, in some cases, when the clients

15   16 are doing tasks for the user or owner of the client 16.

The server 12 may establish a session with each client 16 when an available port exists as indicated in block 28. The server 12 then downloads the software and the data making up the package to the client 16 as indicated in

20   block 30.

The server 12 may await a response from the client 16, as indicated in diamond 32, in one embodiment. When the response is received, the server 12 uploads the results from a given client 16, as indicated in block 34.

25   A check at diamond 36 determines whether a predetermined time period has expired. If so, the server

12 may request client status information as indicated in block 38. In other words, the server 12 may attempt to determine why the client 16 has not completed the task within a predetermined amount of time. In one embodiment,

5   the predetermined amount of time is that time that the server 12 predicted the client 16 would need to complete the assigned task. Thus, the server 12 may determine if a processing error of some type has occurred which has prevented the client 16 from completing the task.

10   In one embodiment, the server 12 automatically requests an upload after the passage of the expected time to complete the task. In other words, in this embodiment the upload is not triggered by a client 16 task completion indication.

15   When a status response is received, as determined in diamond 40, the server 12 may attempt to resolve any log jams as indicated in block 42. For example if a software or hardware crash has occurred, the server 12 may attempt to remotely diagnose and resolve the problem. The server

20   12 may determine that a software upgrade may be needed to complete the task as another example. The server 12 may also send a message to the owner or user of the client 16 requesting completion of certain operations to determine why the client 16 is not operating as expected.

25   Turning next to Figure 3, the software 20 stored on each client 16, accepts the server session message, as

indicated in block 44 in accordance with one embodiment of the present invention. The client 16 then loads the software and stores the data received from the server 12 in order to complete the assigned task, as indicated in block

5   46.

At diamond 48, a check determines whether the client 16 resources are currently available to complete the assigned task. For example, the software 20 can monitor ongoing operations to determine whether the client 16 is

10   currently idle or has been idle for sufficient time to predict that the client 16 will remain idle for a sufficient time to complete the assigned task. In accordance with one embodiment of the present invention, the client 16 may be called upon to check the Advanced

15   Configuration and Power Interface (ACPI) Specification power states to determine the operational state of the client 16. See ACPI Specification (Rev. 1.0, December 22, 1996). Depending on the current power state, the client 16 may be directed to run the software and data received from

20   the server 12, as indicated in block 50.

Once the execution of the assigned task is completed, the server 12 may be notified, as indicated in block 52. In one embodiment, the client 16 may send a message to the server 12 indicating that the client 16 has completed the

25   assigned task.

A check at diamond 54 may determine whether a server session has been established between the client 16 and the server 12. In one embodiment of the present invention, the server 12 may initiate a session with the client 16 when

5   sufficient server 12 resources are available. In another embodiment, the session may be initiated at a predefined time. For example, the server session may be initiated late at night when it is unlikely that a user will be using the client 16.

10   When the server session begins, as determined in diamond 54, the results obtained by the client 16 may be uploaded to the server 12, as indicated at block 56. The session may be maintained until the server 12 provides an acknowledgement that the results were correctly received.

15   For example, a checksum may be provided with the uploaded results that enable the server 12 to ensure that the results have been uploaded correctly. When the client receives an acknowledgement from the server 12 that the results were received correctly, as determined in diamond

20   58, the client 16 may automatically delete the software and data that was downloaded earlier from the server 12, as indicated in block 60 in the embodiment. This ensures that client resources do not become unnecessarily taxed by indeterminately storing software and data that are of no

25   use to the owner or user of the client 16.

In this way, in some embodiments of the present invention, a third party does not need to depend on a distributed computing arrangement in which the nature, characteristics and number of clients that will participate in a computing project is unknown. Instead, with the clients 16 managed by the server 12, the resources that may be applied to the project are known in advance. As a result, the third party may be given a realistic estimate of when the computing job may be completed. Moreover, because the nature of each client 16 is monitored by the server 12 and the server 12 ensures the health of those clients 16, a more reliable distributed computing arrangement may be achieved. In some cases, each client 16 may be pre-equipped with the software that facilitates the execution of idle cycle distributed computing jobs. Thus, the use of a managed network of consumer-use computing devices to complete distributed computing jobs may be advantageous.

Advantages from such an arrangement to the third party as well as those to the service provider are clear. Additionally, the owners or users of the clients 16 may enjoy reduced operating expenses in some cases. Cost reductions may arise because the proceeds from the sale of otherwise wasted resources may be passed, at least in part, to the consumers who use the clients 16.

While the present invention has been described with respect to a limited number of embodiments, those skilled

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in the art will appreciate numerous modifications and variations therefrom. It is intended that the appended claims cover all such modifications and variations as fall within the true spirit and scope of this present invention.

5   What is claimed is:

1   1.   A method comprising:

2   operating a managed network of consumer-use

3   processor-based devices; and

4   assigning distributed computing tasks to said

5   processor-based devices.

1   2.   The method of claim 1 including establishing a

2   persistent connection between at least one of said devices

3   and a server.

1   3.   The method of claim 1 including subdividing a

2   distributed computing job into tasks and assigning each of

3   said tasks to a different device.

1   4.   The method of claim 3 including logging each task

2   and the assigned device.

1   5.   The method of claim 4 including developing an

2   estimate of the time to task completion.

1   6.   The method of claim 5 including, if no results

2   are received after the passage of said time estimate,

3   querying said device.

1   7.   The method of claim 5 including automatically

2   requesting said results after the passage of said time

3   estimate.

1   8.   The method of claim 1 including maintaining, from

2   a server, the software on said device.

1   9.   The method of claim 1 including receiving the

2   results of said task from a device and providing an

3   acknowledgement to said device when the results are

4   received correctly.

1   10.   The method of claim 1 including receiving a

2   completion message from a device and automatically

3   establishing an upload session to receive the task results.

1   11.   An article comprising a medium storing

2   instructions that enable a processor-based system to:

3   operate a managed network of consumer-use

4   processor-based devices; and

5   assign distributed computing tasks to said

6   processor-based devices.

1   12.   The article of claim 11 further storing

2   instructions that enable the processor-based system to

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3   establish a persistent connection between at least one of
4   said devices and said system.

1   13. The article of claim 11 further storing
2   instructions that enable the processor-based system to
3   subdivide a distributed computing job into tasks and assign
4   each of said tasks to a different device.

1   14. The article of claim 13 further storing
2   instructions that enable the processor-based system to log
3   each task and the assigned device.

1   15. The article of claim 14 further storing
2   instructions that enable the processor-based system to
3   develop an estimate of the time to task completion.

1   16. The article of claim 15 further storing
2   instructions that enable the processor-based system to
3   query a device if no results are received after the passage
4   of said time estimate.

1   17. The article of claim 15 further storing
2   instructions that enable the processor-based system to
3   automatically request said results after the passage of
4   said time estimate.

1   18. The article of claim 11 further storing

2   instructions that enable the processor-based system to

3   maintain the software on a device.

1   19. The article of claim 11 further storing

2   instructions that enable the processor-based system to

3   receive the results of a task from a device and provide an

4   acknowledgement to said device when the results are

5   received correctly.

1   20. The article of claim 11 further storing

2   instructions that enable the processor-based system to

3   receive a completion message from a device and

4   automatically establish an upload session to receive the

5   task results.

1   21. A system comprising:

2   a processor-based device; and

3   a storage coupled to said processor-based device

4   storing instructions that enable said device to operate a

5   managed network of consumer-use processor-based clients and

6   assign distributed computing tasks to said processor-based

7   clients.

1   22. The system of claim 21 wherein said system is a

2   server.

1   23.   The system of claim 22 wherein said server is a
2   system management server.

1   24.   The system of claim 21 wherein said processor-
2   based device has a persistent connection with at least one
3   consumer-use processor-based client.

1   25.   The system of claim 21 wherein said storage
2   stores instructions that enable said processor-based device
3   to divide a distributed computing job into a plurality of
4   tasks, assign said tasks to specific processor-based
5   clients, and estimate the time to complete said job by said
6   clients.

MANAGING A NETWORK OF CONSUMER-USE COMPUTING DEVICES

Abstract of the Disclosure

A managed system of consumer-use processor-based devices may be utilized to reliably complete distributed computing jobs with predictable latency and throughput. Distributed computing jobs may be divided into tasks and distributed to a managed network of consumer-use processor-based devices. In some cases, the nature and characteristics of each of those devices as well as their available resources may be well known to a system service provider or server. Thus, the capability of the network of processor-based devices may be reliably predicted. Particularly where all the devices are maintained remotely from a server, the managed network of processor-based devices may be depended upon to more reliably execute distributed processing tasks assigned by the server.

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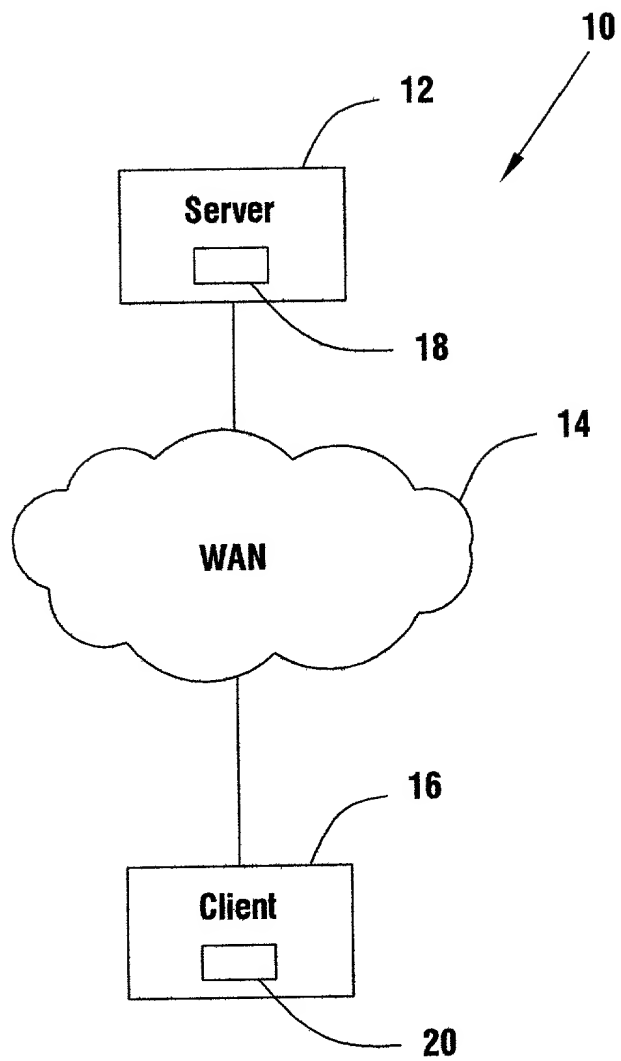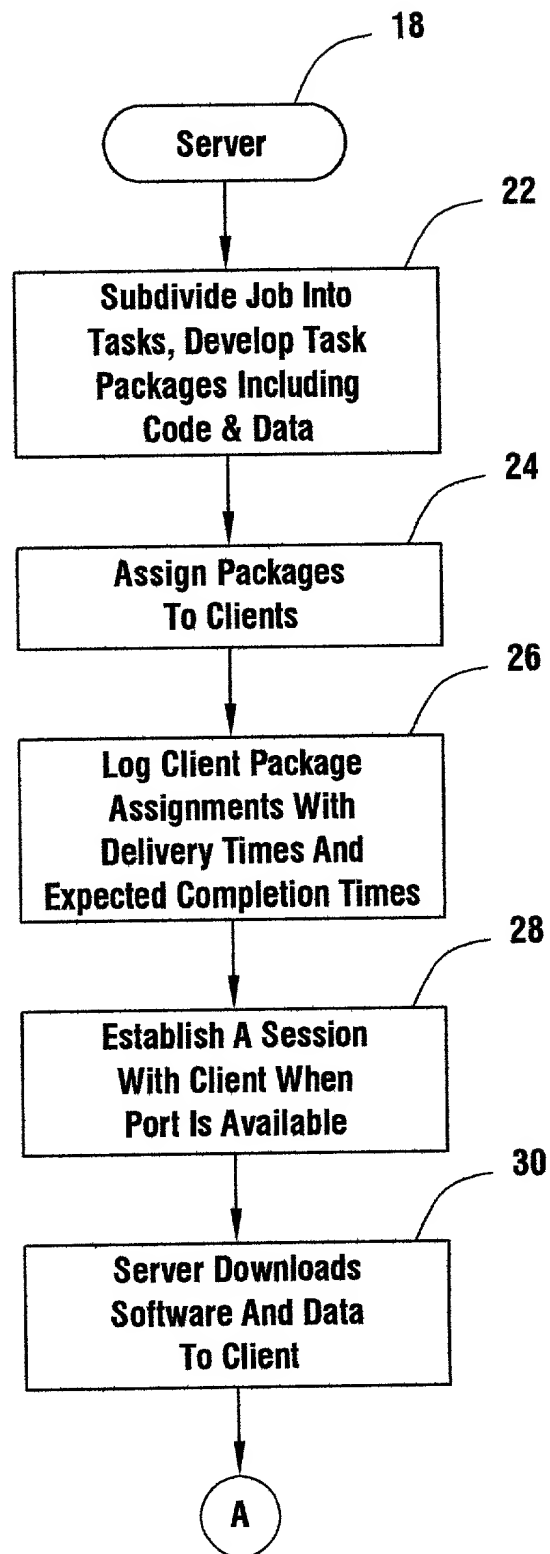
FIG. 1

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Server

22

Subdivide Job Into
Tasks, Develop Task
Packages Including
Code & Data

24

Assign Packages
To Clients

26

Log Client Package
Assignments With
Delivery Times And
Expected Completion Times

28

Establish A Session
With Client When
Port Is Available

30

Server Downloads
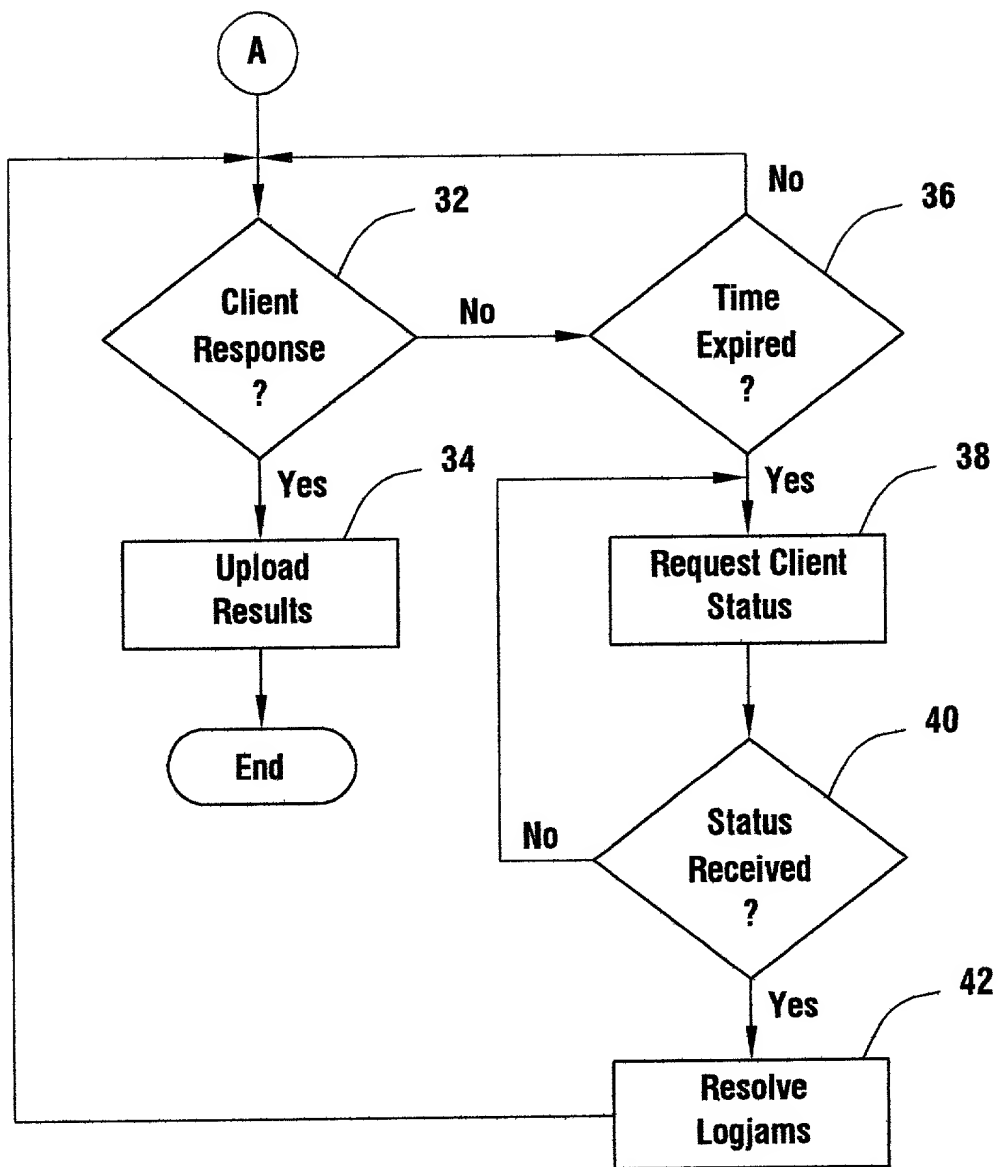Software And Data
To Client

A

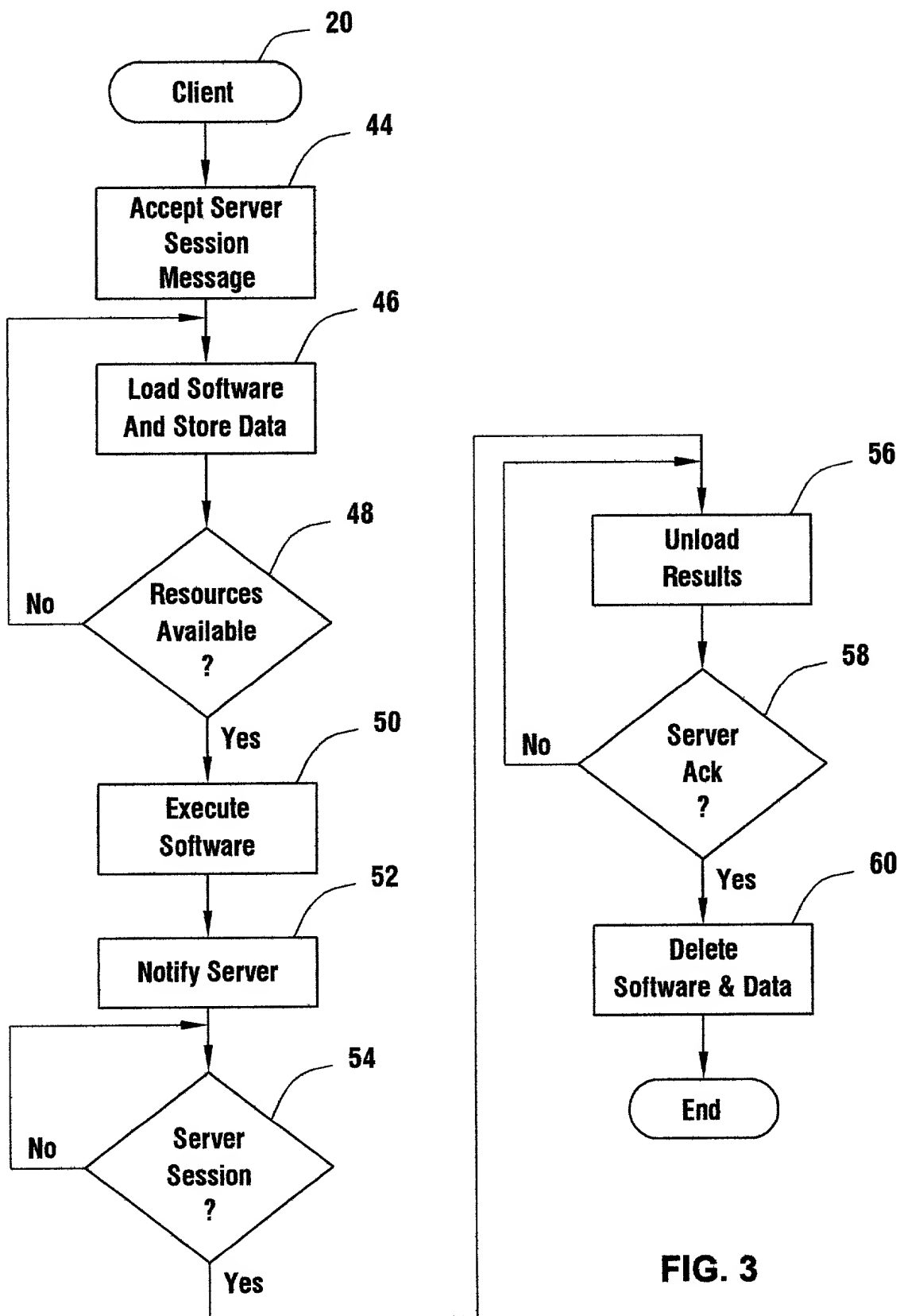**FIG. 2A**

FIG. 2B

FIG. 3

<u>DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION</u>

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

MANAGING A NETWORK OF CONSUMER-USE COMPUTING DEVICES

the specification of which

X	is attached hereto.
	was filed on _____ as
	United States Application Number _____
	or PCT International Application Number _____
	and was amended on _____
	(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above. I do not know and do not believe that the claimed invention was ever known or used in the United States of America before my invention thereof, or patented or described in any printed publication in any country before my invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and that the invention has not been patented or made the subject of an inventor's certificate Issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months (for a utility patent application) or six months (for a design patent application) prior to this application.

I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

<u>Prior Foreign Application(s):</u>			<u>Priority Claimed</u>	
Number	(Country)	(Day/Month/Year Filed)	Yes	No
Number	(Country)	(Day/Month/Year Filed)	Yes	No
Number	(Country)	(Day/Month/Year Filed)	Yes	No

I hereby claim the benefit under title 35, United States Code, Section 119(e) of the United States provisional application(s) listed below:

_____   _____
(Application Number)   (Filing Date)

_____   _____
(Application Number)   (Filing Date)

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

_____   _____   _____
(Application Number)   Filing Date   (Status-patented, pending, abandoned)

_____   _____   _____
(Application Number)   Filing Date   (Status-patented, pending, abandoned)

I hereby appoint Timothy N. Trop, Reg. No. 28,994; Fred G. Pruner, Jr., Reg. No. 40,779 and Dan C. Hu, Reg. No. 40,025 my patent attorneys, of TROP, PRUNER & HU, P.C., with offices located at 8554 Katy Freeway, Ste. 100, Houston, TX 77024, telephone (713) 468-8880, and Mirho, Charles A.; Registration No. 41,199; Novakoski, Leo V.; Registration No. 37,198; Reynolds, Thomas C.; Registration No. 32,488; Seddon, Kenneth M.; Registration No. 43,105; Seeley, Mark; Registration No. 32,299; Skabrat, Steven P.; Registration No. 36,279; Skaist, Howard A.; Registration No. 36,008; Su, Gene I.; Registration No. 45,140; Wells, Calvin E.; Registration No. 43,256; Werner, Raymond J.; Registration No. 34,752; Winkle, Robert G.; Registration No. 37,474; and Young, Charles K.; Registration No. 39,435 my patent attorneys, of INTEL CORPORA-TION with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith.

Send correspondence to Timothy N. Trop, TROP, PRUNER & HU, P.C., 8554 KATY FWY, STE 100, HOUSTON, TX 77024-1805 and direct telephone calls to Timothy N. Trop, (713) 468-8880.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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